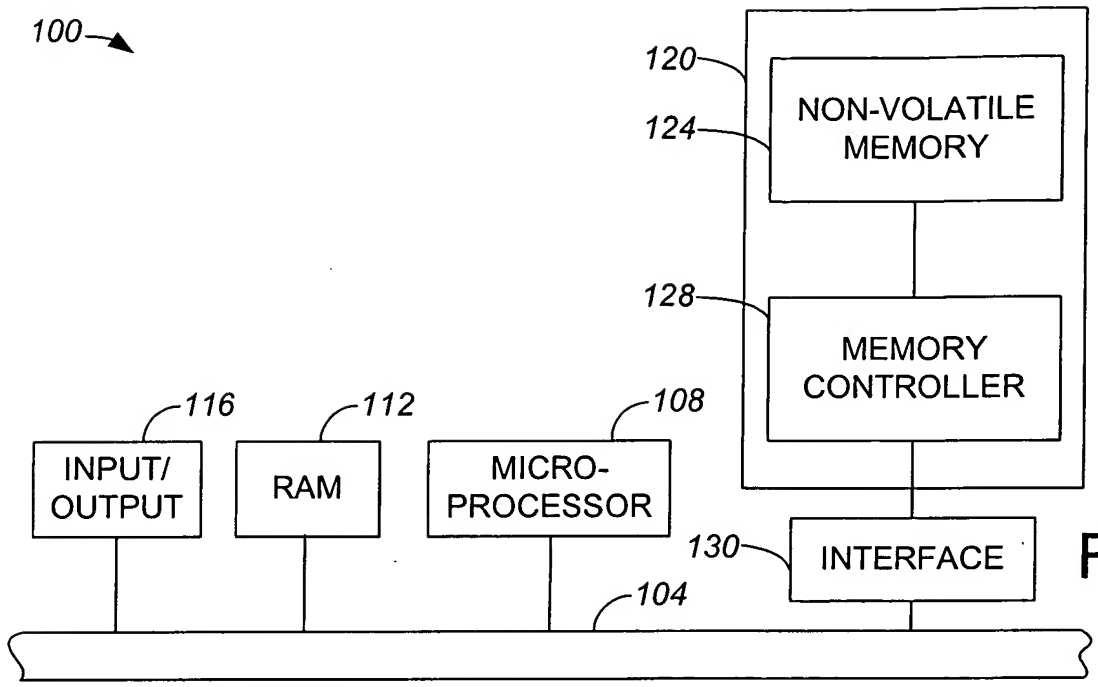
100
120
NON-VOLATILE MEMORY
124
128
MEMORY CONTROLLER
116
112
108
INPUT/ OUTPUT
RAM
MICRO-PROCESSOR
130
INTERFACE
104

Fig. 1a

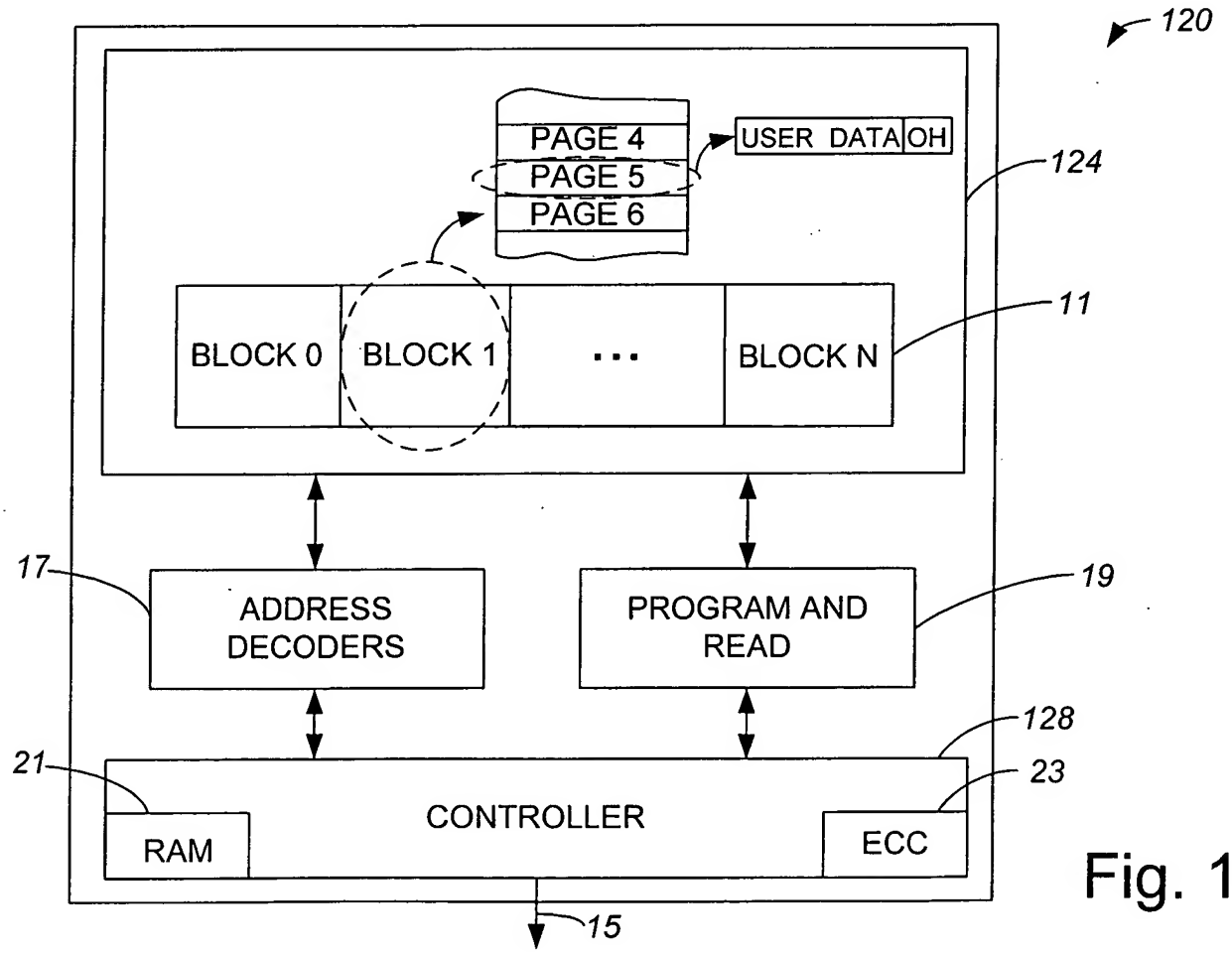
120
PAGE 4
PAGE 5
PAGE 6
USER DATA
OH
124
BLOCK 0
BLOCK 1
...
BLOCK N
11
17
ADDRESS DECODERS
PROGRAM AND READ
19
128
21
23
RAM
CONTROLLER
ECC
15

Fig. 1b

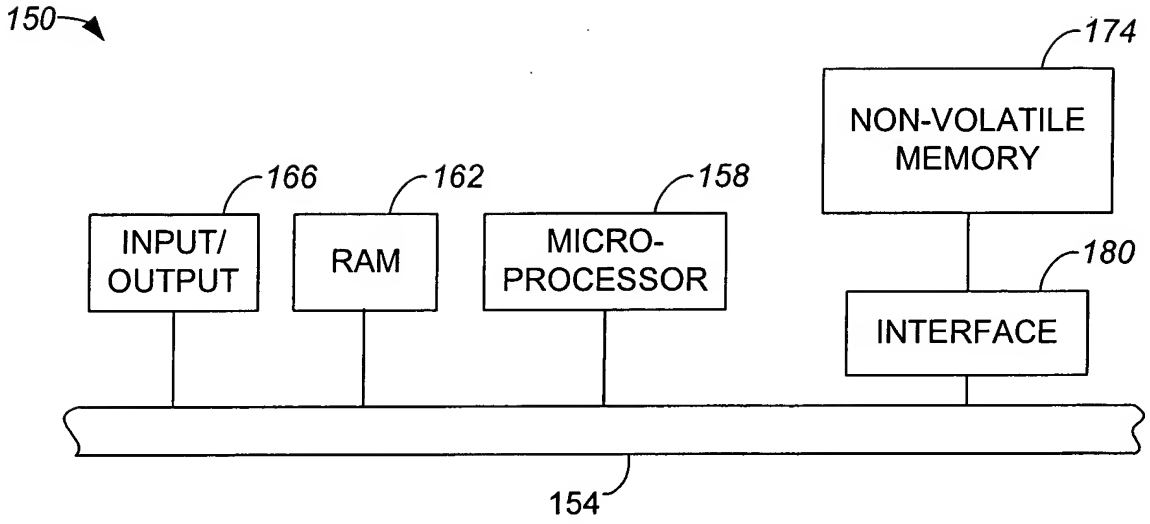
150
174
NON-VOLATILE MEMORY
166
162
158
INPUT/ OUTPUT
RAM
MICRO-PROCESSOR
180
INTERFACE
154

Fig. 1c

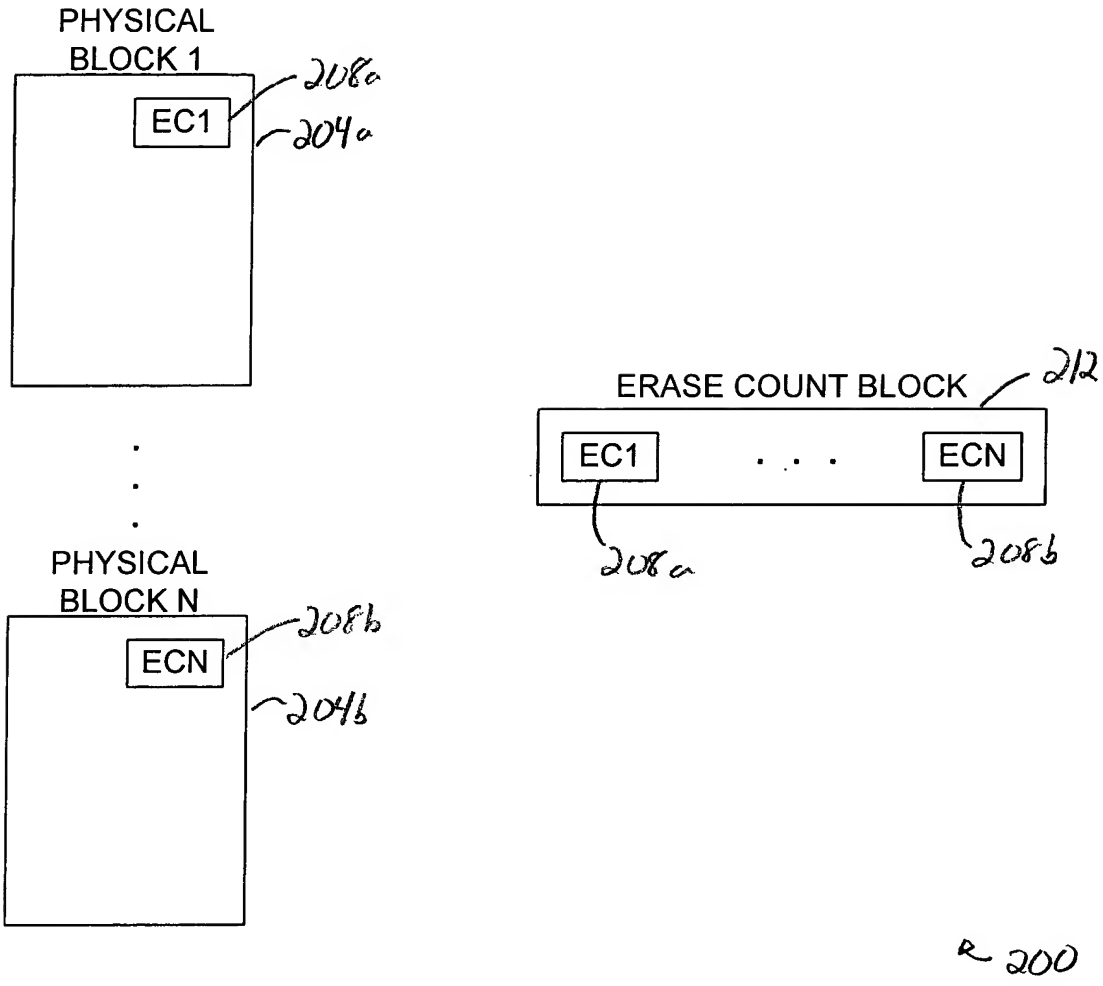
PHYSICAL
BLOCK 1
EC1
208a
204a
PHYSICAL
BLOCK N
ECN
208b
204b
ERASE COUNT BLOCK
212
EC1
. . .
ECN
208a
208b
200

Fig. 2a

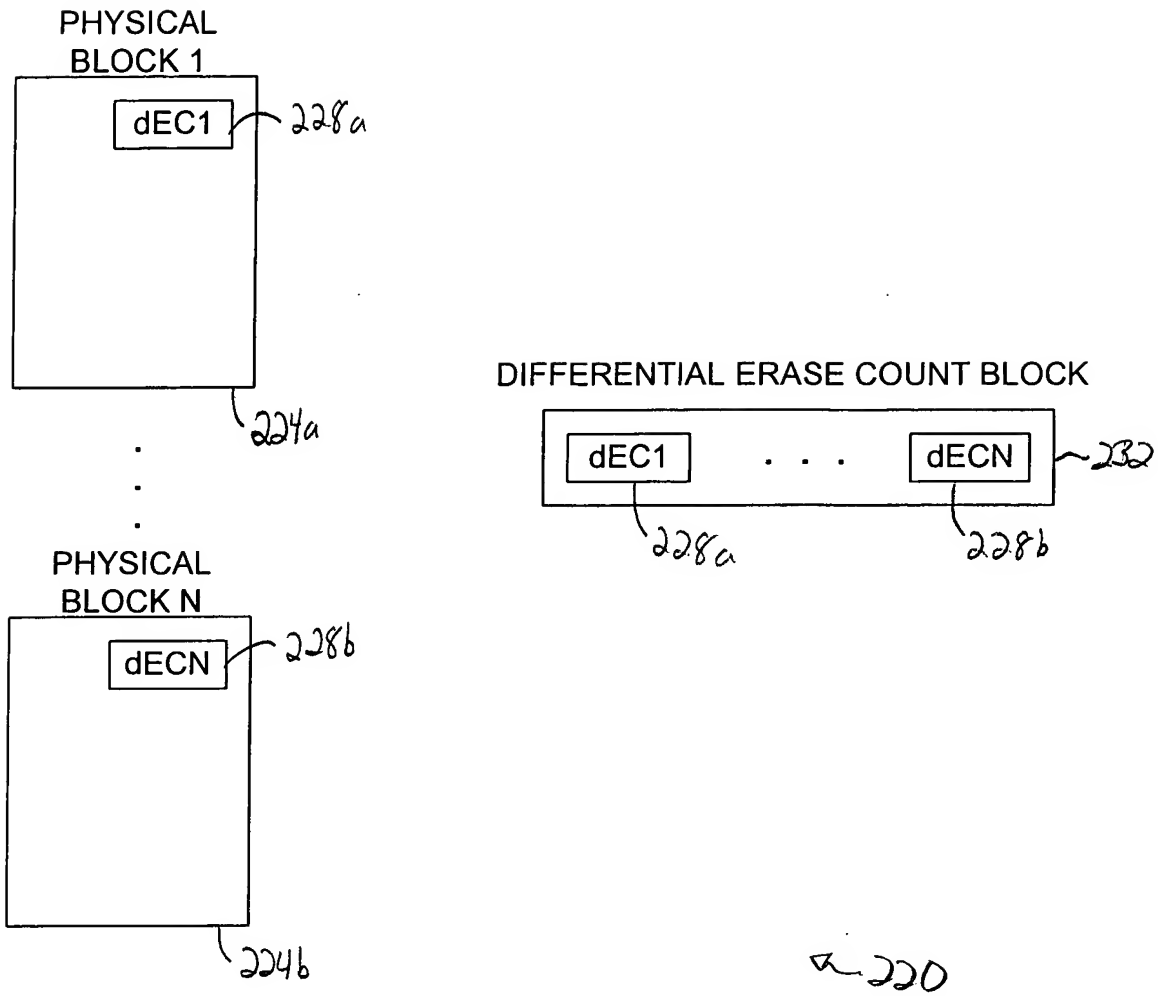
PHYSICAL
BLOCK 1
dEC1
228a
224a
PHYSICAL
BLOCK N
dECN
228b
224b
DIFFERENTIAL ERASE COUNT BLOCK
dEC1
dECN
232
228a
228b
220

Fig. 2b

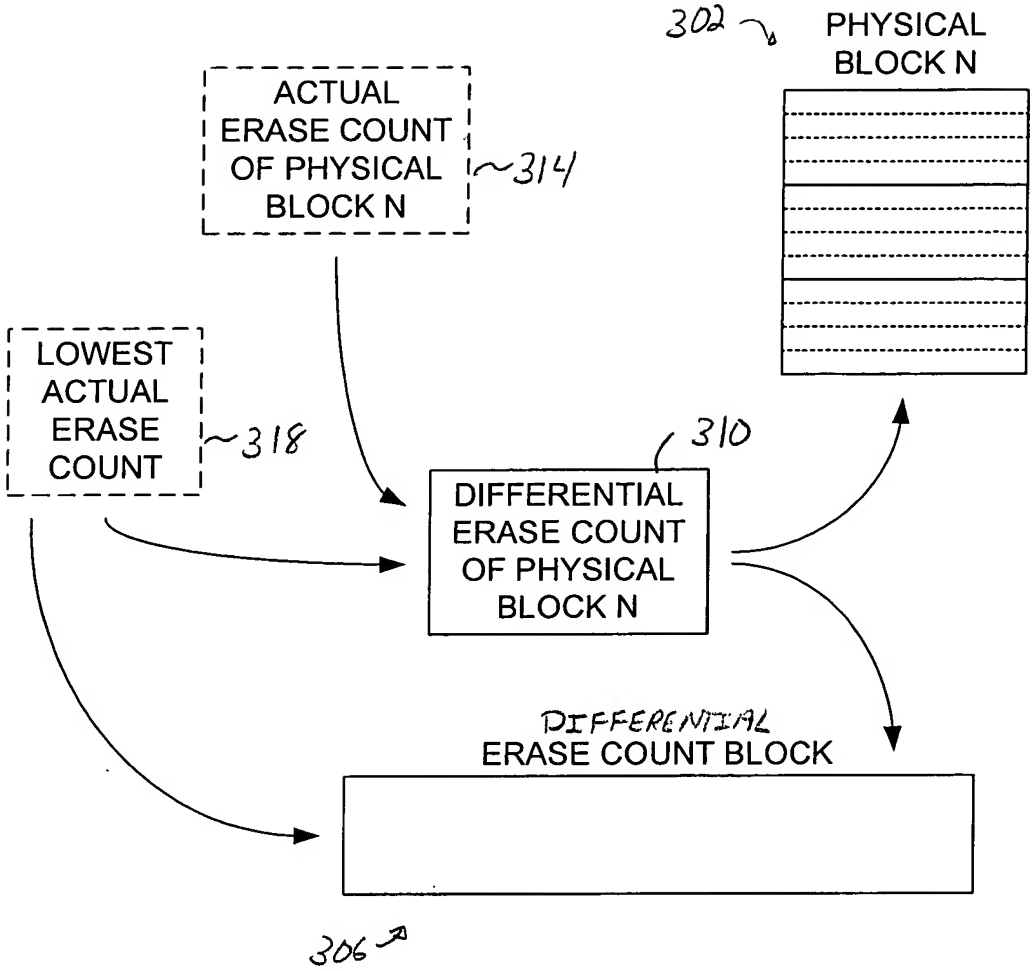
302
PHYSICAL BLOCK N
ACTUAL ERASE COUNT OF PHYSICAL BLOCK N
314
LOWEST ACTUAL ERASE COUNT
318
310
DIFFERENTIAL ERASE COUNT OF PHYSICAL BLOCK N
DIFFERENTIAL ERASE COUNT BLOCK
306

Fig. 3

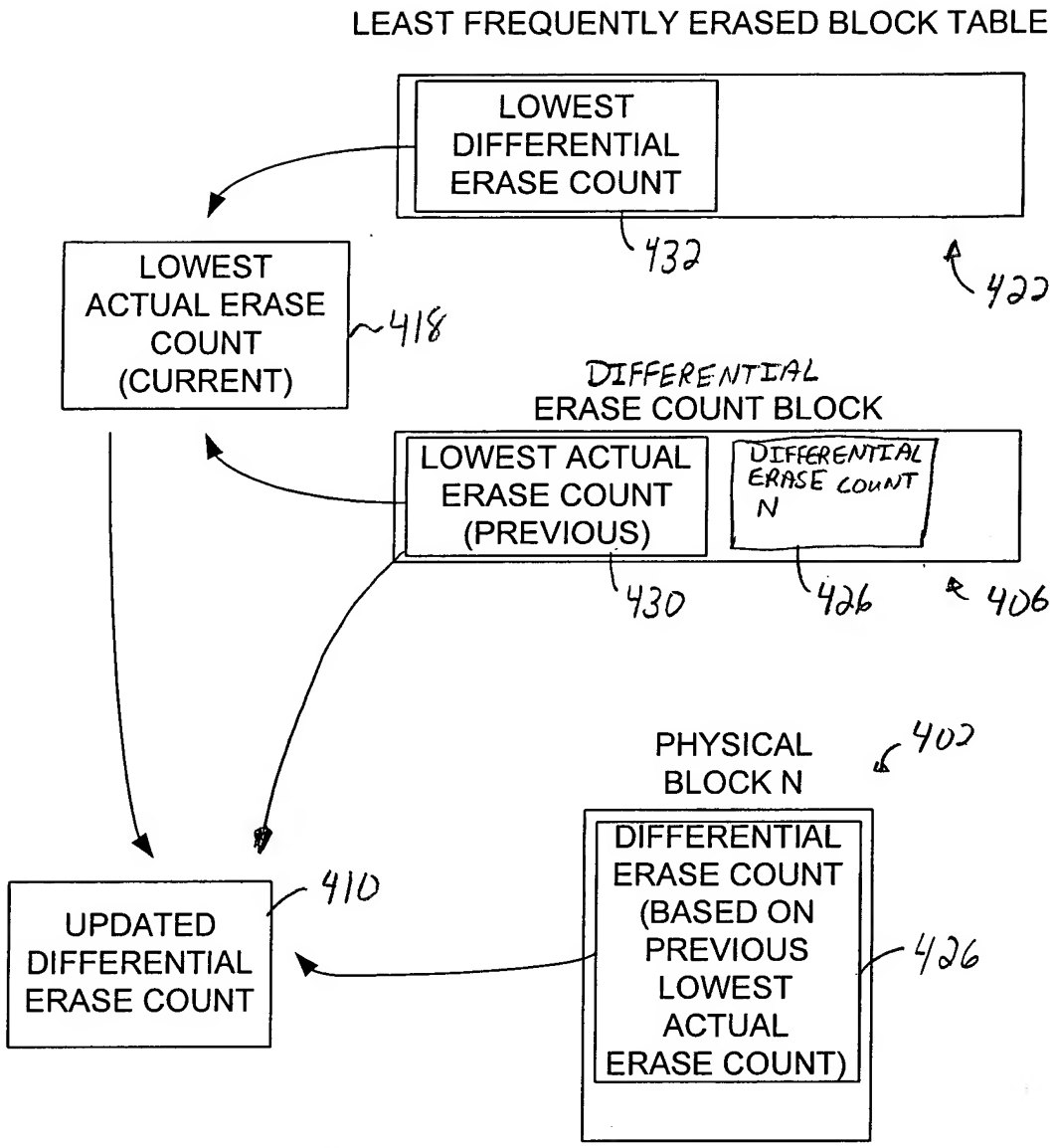
LEAST FREQUENTLY ERASED BLOCK TABLE
LOWEST DIFFERENTIAL ERASE COUNT
432
422
LOWEST ACTUAL ERASE COUNT (CURRENT)
418
DIFFERENTIAL ERASE COUNT BLOCK
LOWEST ACTUAL ERASE COUNT (PREVIOUS)
DIFFERENTIAL ERASE COUNT N
430
426
406
PHYSICAL BLOCK N
402
UPDATED DIFFERENTIAL ERASE COUNT
410
DIFFERENTIAL ERASE COUNT (BASED ON PREVIOUS LOWEST ACTUAL ERASE COUNT)
426

Fig. 4

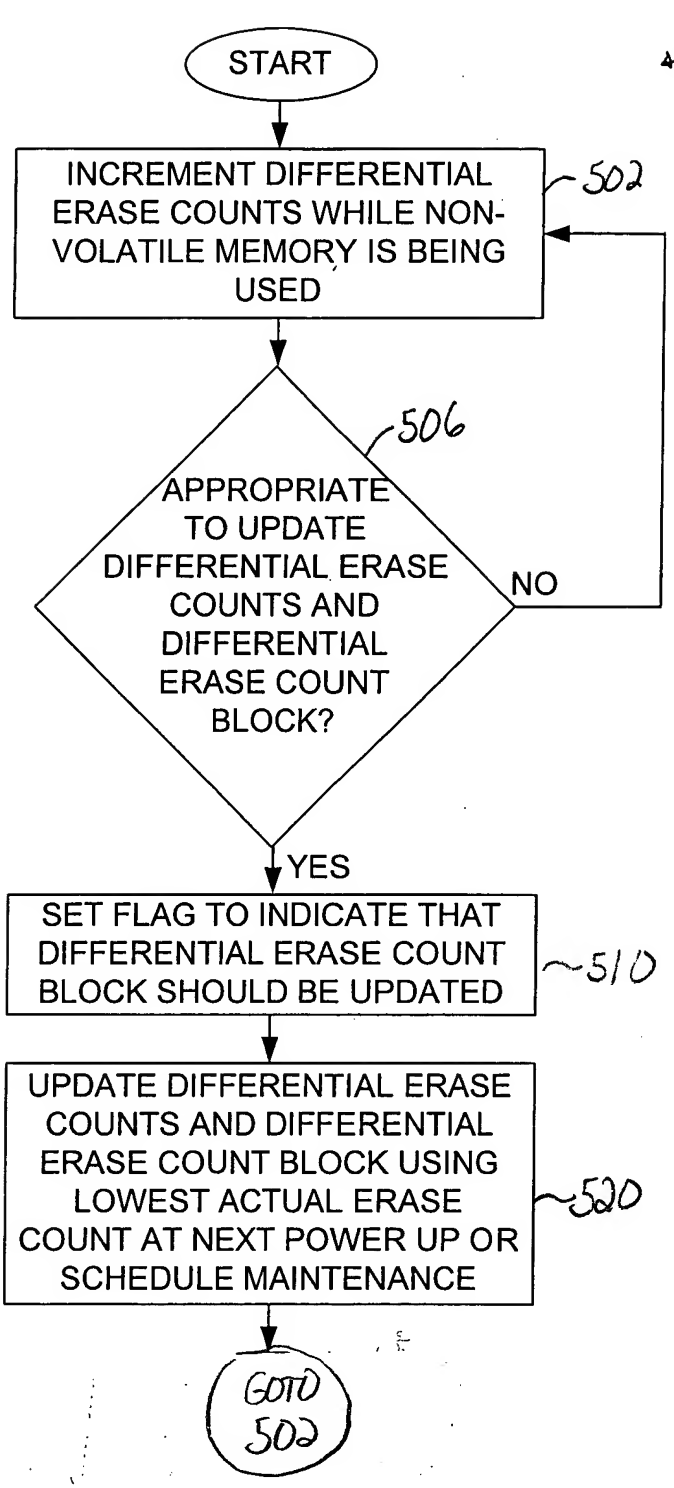
500
START
INCREMENT DIFFERENTIAL ERASE COUNTS WHILE NON-VOLATILE MEMORY IS BEING USED
502
506
APPROPRIATE TO UPDATE DIFFERENTIAL ERASE COUNTS AND DIFFERENTIAL ERASE COUNT BLOCK?
NO
YES
SET FLAG TO INDICATE THAT DIFFERENTIAL ERASE COUNT BLOCK SHOULD BE UPDATED
510
UPDATE DIFFERENTIAL ERASE COUNTS AND DIFFERENTIAL ERASE COUNT BLOCK USING LOWEST ACTUAL ERASE COUNT AT NEXT POWER UP OR SCHEDULE MAINTENANCE
520
GOTO 502

Fig. 5

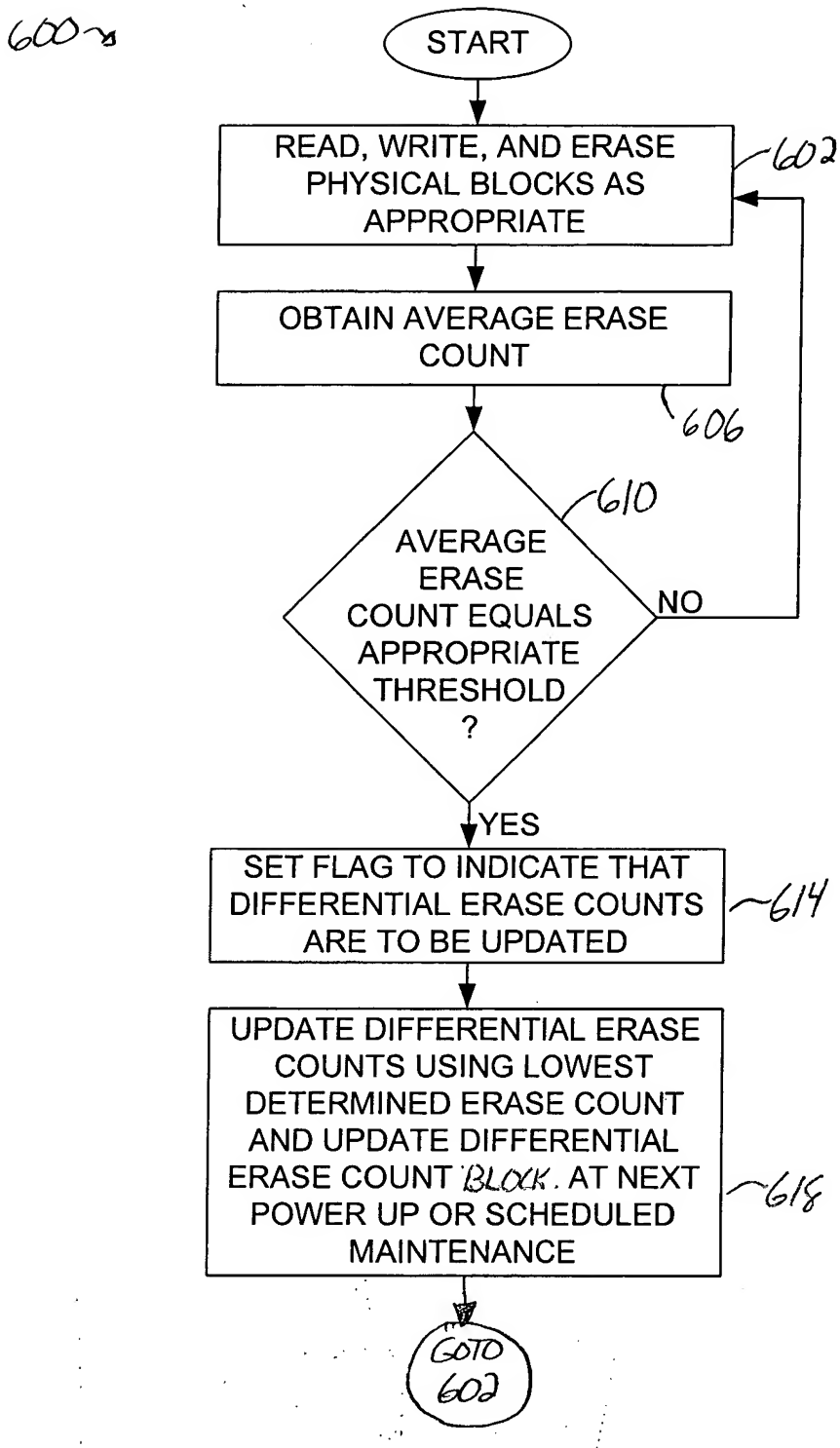
600
START
READ, WRITE, AND ERASE PHYSICAL BLOCKS AS APPROPRIATE
602
OBTAIN AVERAGE ERASE COUNT
606
610
AVERAGE ERASE COUNT EQUALS APPROPRIATE THRESHOLD ?
NO
YES
SET FLAG TO INDICATE THAT DIFFERENTIAL ERASE COUNTS ARE TO BE UPDATED
614
UPDATE DIFFERENTIAL ERASE COUNTS USING LOWEST DETERMINED ERASE COUNT AND UPDATE DIFFERENTIAL ERASE COUNT BLOCK. AT NEXT POWER UP OR SCHEDULED MAINTENANCE
618
GOTO 602

Fig. 6

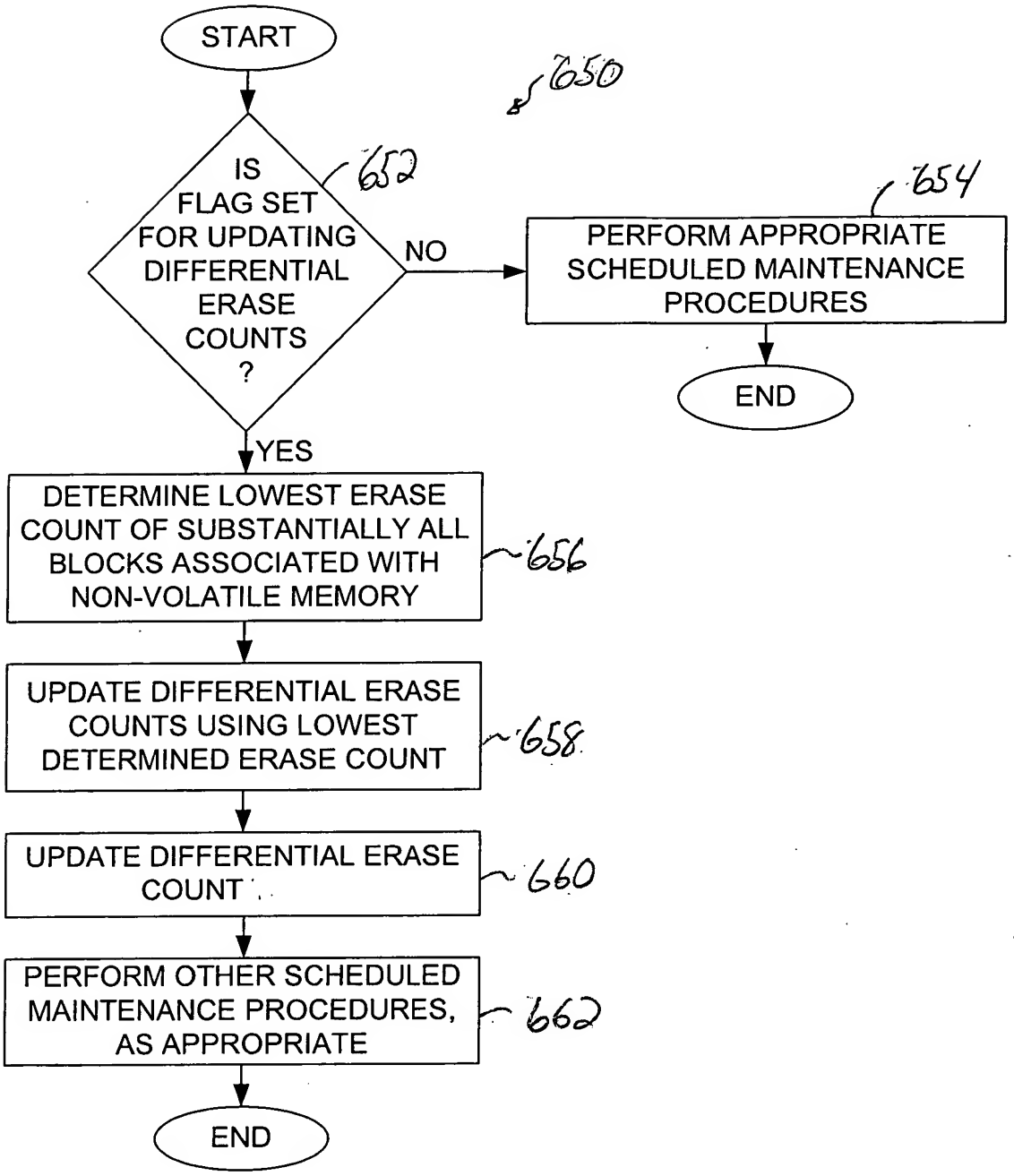
START
650
IS FLAG SET FOR UPDATING DIFFERENTIAL ERASE COUNTS ?
652
NO
PERFORM APPROPRIATE SCHEDULED MAINTENANCE PROCEDURES
654
END
YES
DETERMINE LOWEST ERASE COUNT OF SUBSTANTIALLY ALL BLOCKS ASSOCIATED WITH NON-VOLATILE MEMORY
656
UPDATE DIFFERENTIAL ERASE COUNTS USING LOWEST DETERMINED ERASE COUNT
658
UPDATE DIFFERENTIAL ERASE COUNT
660
PERFORM OTHER SCHEDULED MAINTENANCE PROCEDURES, AS APPROPRIATE
662
END

Fig. 7

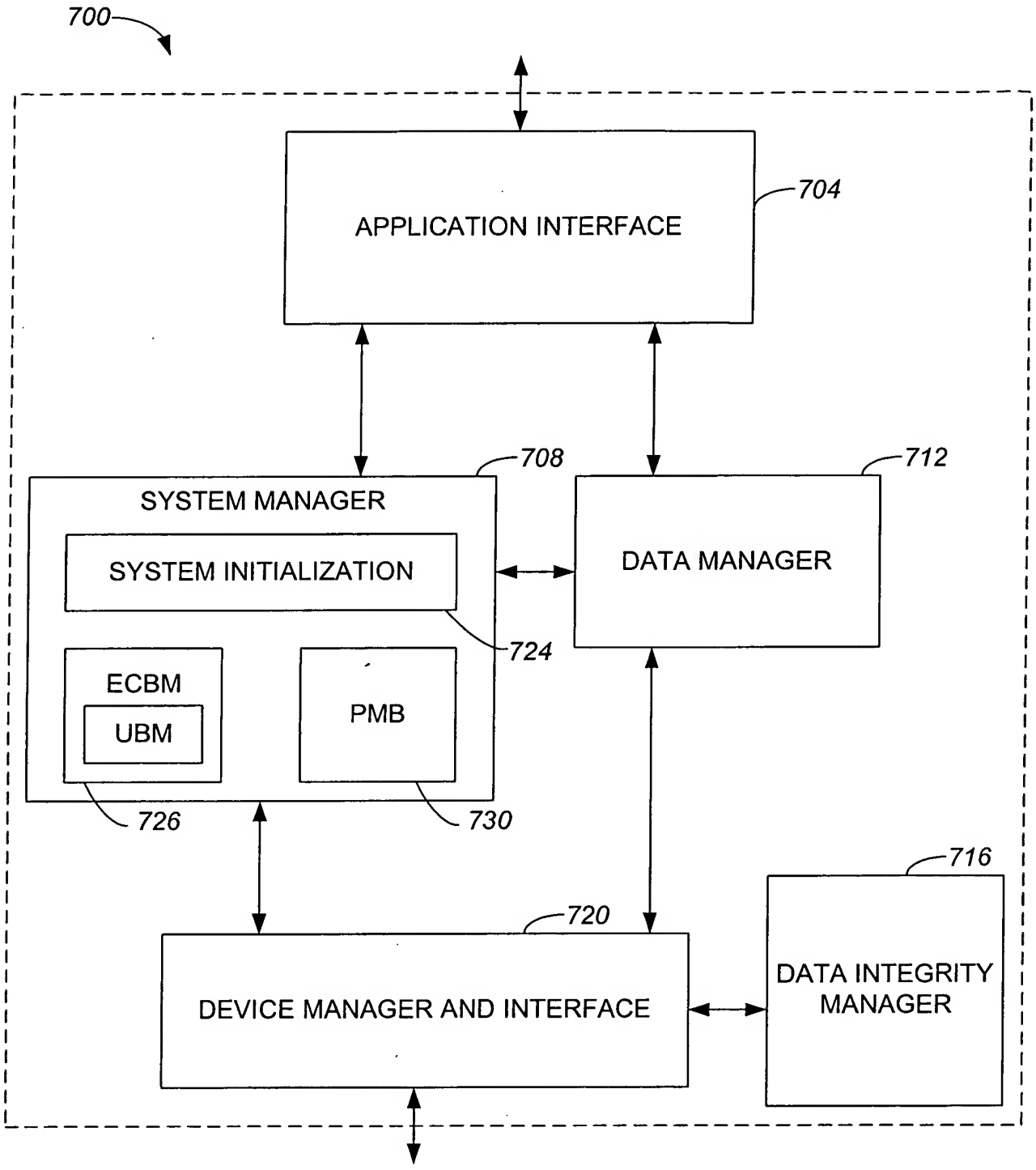
700
APPLICATION INTERFACE
704
SYSTEM MANAGER
708
SYSTEM INITIALIZATION
724
ECBM
UBM
PMB
726
730
DATA MANAGER
712
716
720
DEVICE MANAGER AND INTERFACE
DATA INTEGRITY MANAGER

Fig. 8